Mortality and Morbidity From Exposure to Excessive Natural Heat in Arizona, 2005-2015

ARIZONA DEPARTMENT
OF HEALTH SERVICES

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MORTALITY AND MORBIDITY FROM EXPOSURE TO EXCESSIVE NATURAL HEAT IN ARIZONA, 2005-2015

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Purpose

The purpose of this report is to provide information on trends in deaths from exposure to heat due to weather conditions occurring in Arizona, 2005-2015 and heat illness cases during 2015 data year. Exposure to natural heat poses a public health concern because it may lead to heat-related illness such as heat exhaustion or heat stroke, and heat-related death. Unlike our other reports, designed to monitor health status of the residents of Arizona, this publication focuses on mortality and morbidity occurring in the State to both residents and non-residents.

The current report updates to some extent information presented in the previous report *Trends in Morbidity and Mortality from Exposure to Excessive Natural Heat in Arizona, 2012.*

Methods and Sources

The *International Classification of Diseases* (ICD) permits the classification of environmental events and circumstances as the external cause of injury death. Beginning with the 2000 data year in Arizona (1999 nationally) the Tenth Revision of the International Classification of Diseases (ICD-10) has replaced the Ninth Revision (ICD-9), which was in effect since 1979. Exposure to excessive natural heat as the underlying (primary) cause of death is identified by a three-character category X30 in the Tenth Revision and corresponding to it code E900.0 in the Ninth Revision. In this report, the deaths from exposure to heat due to weather conditions are classified by ICD-9 for 1992-1999 and by ICD-10 beginning 2000. In addition to death certificates where exposure to excessive natural heat was indicated as the underlying cause of death, heatstroke or sunstroke may be reported on death certificates as contributing factors that had a bearing on the death, but were not its underlying cause. Those heat-related deaths are beyond the scope of this report.

In this report, heat illnesses are derived from the Hospital Discharge Data (HDD) of the state of Arizona. Hospitalizations (inpatient admissions) and emergency department (ED) visits for heat illness (hyperthermia) due to exposure to excessive natural heat are classified using ICD-9 codes. Heat illness cases are restricted to patients having an ICD-9-CM 992 diagnosis listed as the principal diagnosis code. The principal diagnosis code is the ICD code describing the principal diagnosis (i.e. the condition established after study to be chiefly responsible for occasioning the admission of the patient for care). E codes are not reported in this field and have separate fields designated for the purpose of reporting. Patients were removed for having an ICD-9 code E900.1 (man-made source of heat) as a cause of injury or other diagnosis. Hospitalization dates were classified by time using admission date. Cases were counted once per hospitalization.

Limitations of the Data

In this report we distinguish three groups at risk of death from exposure to excessive natural heat: *Arizona residents*, *visitors to Arizona from other U.S. states, Canada or Europe*, and migrants *from Mexico, Central America, or South America.*

These groups differ not only in size but also with regard to sociodemographic characteristics, such as age composition, gender, occupation, or race/ethnicity. One of the primary objectives in the comparative analysis of mortality is to measure the likelihood (or risk) of death in the specified population during a particular time. Mortality rates express the likelihood of death – the frequency of a vital event (such as death) in the numerator occurring to individuals in the denominator – and they are generally expressed as units of population in the denominator (per 1,000, 10,000, 100,000, and so forth). It is important to note that the risk of death expressed as mortality rate can only be computed for the residents of Arizona. Neither the number of visitors to Arizona during a calendar year, nor the number of illegal border crossers can be estimated with any precision.

While comparisons are made among these groups, correlations between the increased number of deaths from exposure to excessive natural heat among migrants from Mexico, Central America, and South America and undocumented persons is beyond the scope of this report.

The value of comparing the absolute number of deaths, rather than group-specific relative frequencies, ought not to be overestimated. On the other hand, from an epidemiological or public health viewpoint, the number of deaths from a rare cause may be of great importance even if the statistically reliable mortality rate cannot be computed.

The total burden of illness from exposure to excessive natural heat may be larger than is indicated in this report. ADHS collects hospital discharge records for inpatient and emergency department visits from all Arizona licensed hospitals. Records do not capture illness cases that recover without medical intervention or were treated at an urgent care facility. The collection of data from hospitals is required by Arizona Revised Statute (A.R.S.) § 36-125-05 and Arizona Administrative Code Title 9, Chapter 11, Articles 4 and 5. All Arizona licensed hospitals (i.e. regulated by the Arizona Department of Health Services) are required to report.

Therefore, hospitals such as Veteran's Administration Department of Defense, and those located on tribal land, are not included in reporting.

When examining heat morbidity in this report, we examined patients whose primary reason for hospitalization was caused by exposure to excessive natural heat. A case where a heat diagnosis (992) is listed as one of the up to 24 secondary diagnoses is beyond the scope of this report.

Summary of Findings

√ From 2005 to 2015, there were 1,272 deaths from exposure to heat due to weather conditions occurred in Arizona.

√ The annual number of deaths due to this cause decreased from 225 in 2005 to 88 in 2008, followed by a period of increase of about 150 deaths between 2009 and 2011, then a decline to 97 in 2012, and to 48 in 2014. In 2015, the number of deaths from exposure to excessive natural heat decreased to 83.

√ There were 536 deaths from exposure to excessive natural heat among the residents of Arizona (42.1 percent of the total), or 49 deaths on average per year in 2005-2015.

√ Visitors to Arizona from other U.S. states, Canada or Europe experienced 81 deaths from exposure to heat due to weather conditions in 2005-2015.

√ The state or country of residence of the 134 decedents in 2005-2015 remains unidentified.

√ Approximately eight out of every ten deaths from exposure to excessive natural heat in 2005-2015 were males, and 51.9 percent were Hispanic or Latino.

√ In 2005-2015, ninety-five percent of all deaths from exposure to heat due to weather conditions occurred during the five months from May through September.

√ In 2005-2015, deaths from exposure to excessive natural heat among migrants to Arizona occurred at younger ages compared to deaths from natural heat among the state's residents. Young adults 20-44 years old accounted for 70 percent of deaths from exposure to excessive natural heat among the migrants from Mexico and other Central/South American countries.

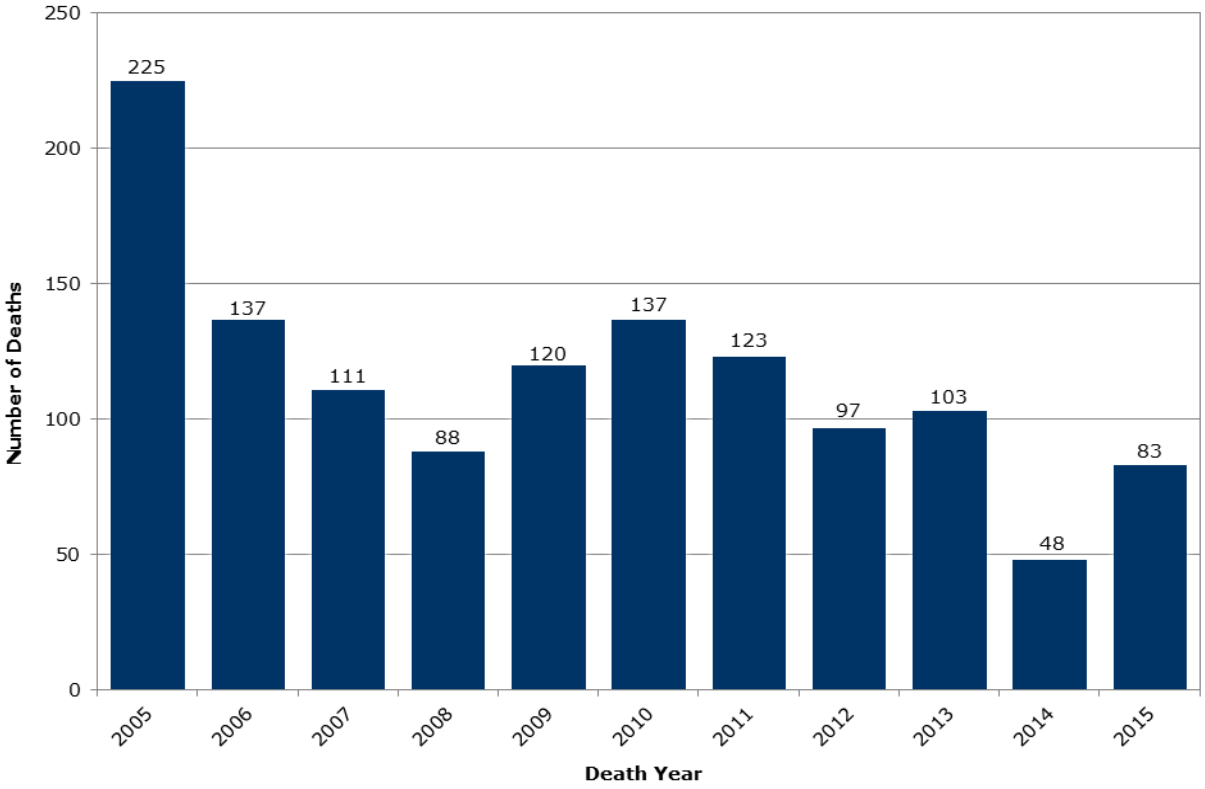
√ In contrast, older adults 65 years or older have been at the highest risk of heatstroke or sunstroke among the age groups of Arizona residents. Approximately 38.4 percent of fatalities due to exposure to heat among Arizona residents were this old, while there were no deaths from natural heat recorded among migrants aged 65 years and older.

√ In 2005-2015, the four counties along the southern border of Arizona (Cochise, Pima, Santa Cruz, and Yuma) accounted for 53.9 percent of deaths from excessive heat. Individually, Pima county (43.0 percent) and Maricopa county (35.59 percent) accounted for most of the deaths due to exposure to natural heat.

√ Residents from Mexico, Central or South America (67.2 percent) were largely represented in the total counts of death due to heat in Pima County, while in Maricopa the majority of deaths from heat were recorded among Arizona residents (82.5 percent) .

Section A: Heat-Related Mortality, 2005-2015

Figure 1A
Deaths from Exposure to Excessive Natural Heat* occurring in Arizona by Year, 2005-2015



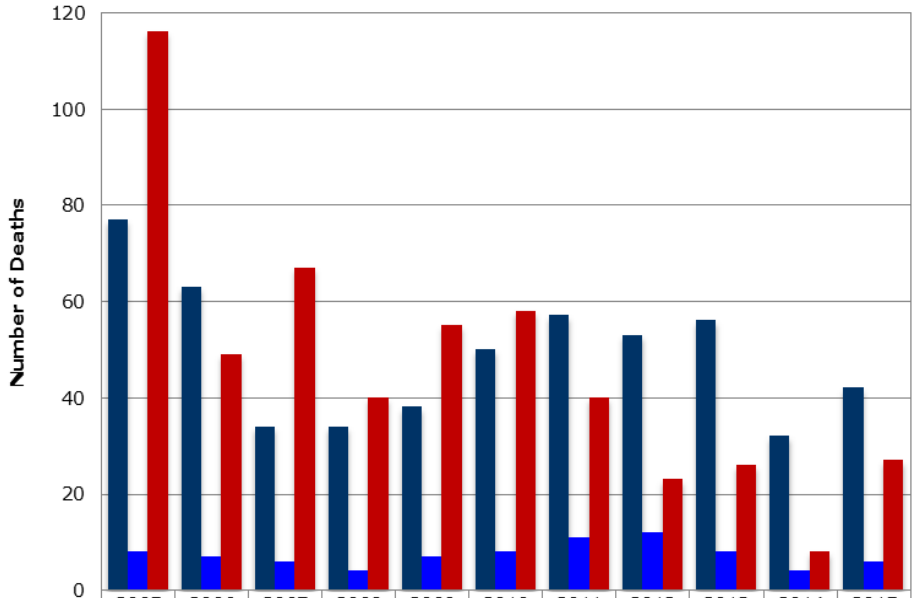
In the year period from 2005 to 2015 1,272 deaths related to exposure to excessive natural heat occurred in Arizona.

The number of deaths from exposure to excessive natural heat has shown a wide variation from year to year (low = 48 deaths in 2014, high = 225 deaths in 2005. On average, 116 people died every year from a heatstroke or sunstroke between 2005-2015 (**Figure 1A, Table 1A**).

Approximately seven out of every ten deaths from exposure to excessive natural heat in 2005-2015 were males (977/1,272 or 76.8 percent, **Table 1A**), and 51.9 percent (660/1,272, **Table 1A**) were Hispanic or Latino.

* The underlying cause of death was classified as X30 by ICD-10. Included are deaths occurring in Arizona from excessive heat due to weather conditions as the cause of heatstroke or sunstroke among both residents of Arizona and non-residents. Excluded are deaths due to excessive heat of man-made origin.

Figure 2A
Deaths from Exposure to Excessive Natural Heat* occurring in Arizona by State or Country of Residence and Year, 2005-2015



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Arizona	77	63	34	34	38	50	57	53	56	32	42
Other U.S. states or Canada	8	7	6	4	7	8	11	12	8	4	6
Mexico, Central or South America	116	49	67	40	55	58	40	23	26	8	27

* The underlying cause of death was classified as X30 by ICD-10. Included are deaths occurring in Arizona from excessive heat due to weather conditions as the cause of heatstroke or sunstroke among both residents of Arizona and non-residents. Excluded are deaths due to excessive heat of man-made origin. Deaths from other or unknown county of residents are not represented in the graph.

There were 536 deaths from exposure to excessive natural heat among the residents of Arizona (42.1 percent of the total), or 49 deaths on average per year in 2005-2015.

Migrants from Mexico, Central America or South America accounted for 40.0 percent of the total deaths from exposure to heat due to weather conditions during the 2005 to 2015 period.

Visitors to Arizona from other U.S. states or migrants from Canada experienced 81 deaths from exposure to excessive natural heat during the 2005-2015, period.

Arizona's Sonoran Desert is where the Greater Phoenix metropolitan area is located and where temperatures oftentimes reach triple digits during the summer months. The number of deaths from exposure to excessive natural heat were highest for both Arizona residents and migrants from Mexico, Central American, and South American countries during 2005, however, the highest reported temperatures for the Greater Phoenix area during this period were in 2006 and 2010, both reporting temperatures of 118 degrees Fahrenheit[1]. No significant climate changes were reported which might explain the number of deaths in Arizona from natural heat.

1 http://phoenix.about.com/cs/weather/a/weathertrivia_2.htm

In Phoenix, Arizona, normal daily maximum temperature reaches ≥100^0 F in early June and can remain at that level until mid-September. The historical data collected by the Western Regional Climate Center demonstrate that the temperature of 100^0 can be reached as early as March and continue through October.[2] Temperatures exceeding 125^0 F have been observed in the desert area.

The authors of "*Impact of Excess Heat Events in Maricopa County, Arizona, 2000-2005*"[3] rightly point out that in a desert environment such as Maricopa County where summer temperatures average 98°F – 107°F, a heat wave[4] is a summer-long experience.

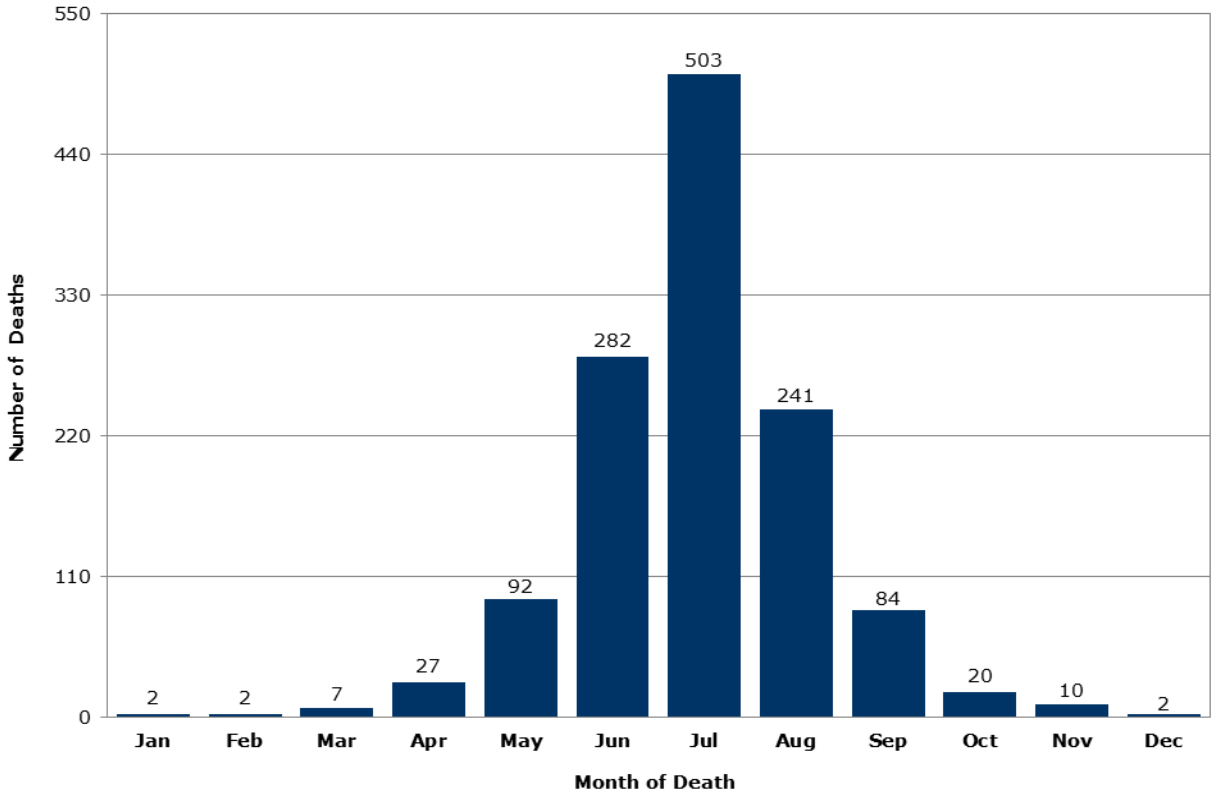
Not surprisingly, most deaths from excessive natural heat occurred during summer and late spring (**Figure 3A**, **Table 2A**, **Table 3A**), with the highest number of deaths occurring during the month of July (503 in 2005-2015), followed by June (282), then August (241) May (92) and ,September (84). In 2005-2015, approximately ninety-five percent of all deaths from exposure to heat due to weather conditions occurred during the five months from May through September.

2 http://www.wrcc.dri.edu/cgi-bin/clilcd.pl?az23183

3 Fuyuen Yip, W.D Flanders, A. Wolkin, D. Engelthaler, W. Humble, A. Neri, L. Lewis, L. Backer, C. Rubin. CDC: National Center for Environmental Health, Health Studies Branch, 2006

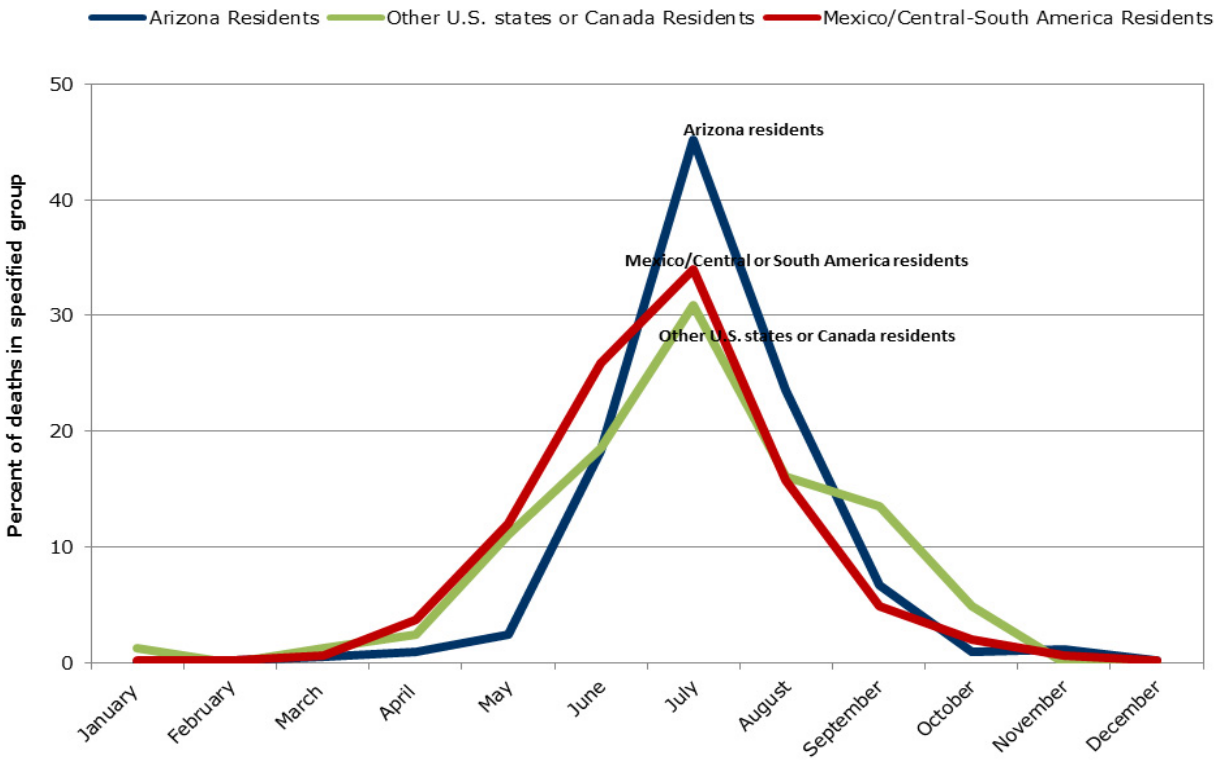
4 Defined by the National Weather Service as three or more consecutive days of maximum temperatures >90o F

Figure 3A
Deaths from Exposure to Excessive Natural Heat* occurring in Arizona by Month, 2005-2015



* The underlying cause of death was classified as X30 by ICD-10. Included are deaths occurring in Arizona from excessive heat due to weather conditions as the cause of heatstroke or sunstroke among both residents of Arizona and non-residents. Excluded are deaths due to excessive heat of man-made origin.

Figure 4A
Percent Distribution of Deaths from Exposure to Excessive Natural Heat* occurring in Arizona by Month and Residence Status, 2005-2015



* The underlying cause of death was classified as X30 by ICD-10.

Deaths from other or unknown county of residents are not represented in the graph.

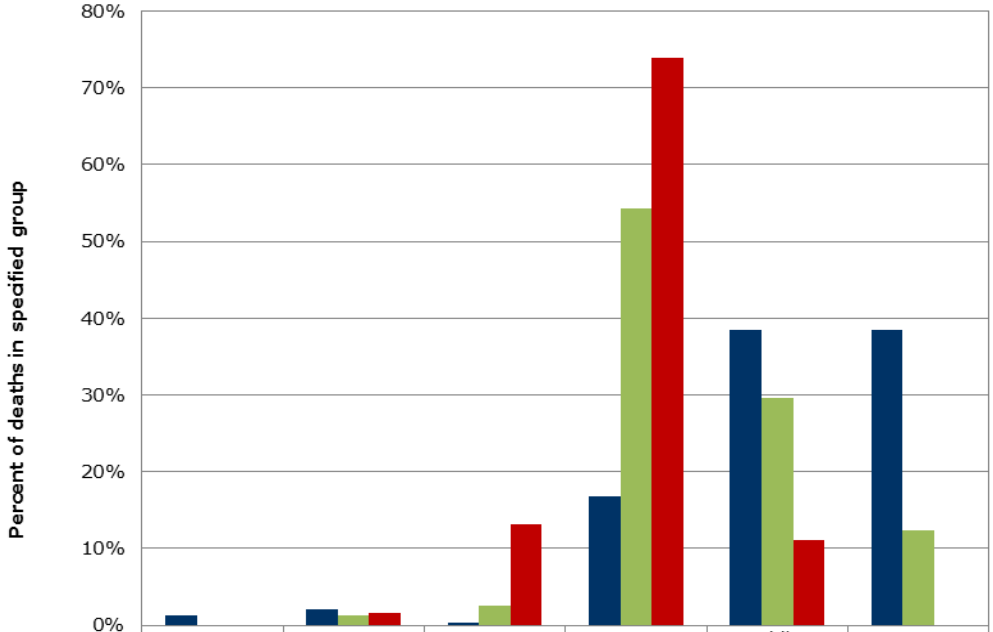
Regardless of the residence status, most deaths from excessive natural heat occurred during the month of July (**Figure 4A, Table 2A**). Compared to the residents of Arizona there were substantially more deaths among residents of Mexico, Central America, and South America from March–June during the 2005-2015 period. In contrast, the number of deaths from excessive natural heat among Arizona residents exceeded the number of deaths from either the two remaining groups in both July and August.

The difference in the seasonal pattern of mortality may mean that fewer migrants entered Arizona in July and August, the two summer months with the highest temperatures (**Table 2A**).

In 2005-2015, deaths from exposure to excessive natural heat among migrants to Arizona occurred at younger ages compared to deaths from natural heat among the State's residents (**Figure 5A**). In fact, young adults 20-44 years old during 2005-2015 accounted for 73.9 percent of deaths from exposure to excessive natural heat among the migrants from Mexico and other Central/South American countries.

In contrast, middle-aged adults and adults 65 years or older have been at the highest risk of heatstroke or sunstroke among the age groups of Arizona residents. Thirty eight percent of fatalities due to exposure to heat occurred among Arizona residents aged 65 years or older. While there were no deaths recorded among migrants from Mexico and other Central/South American countries of that age group.

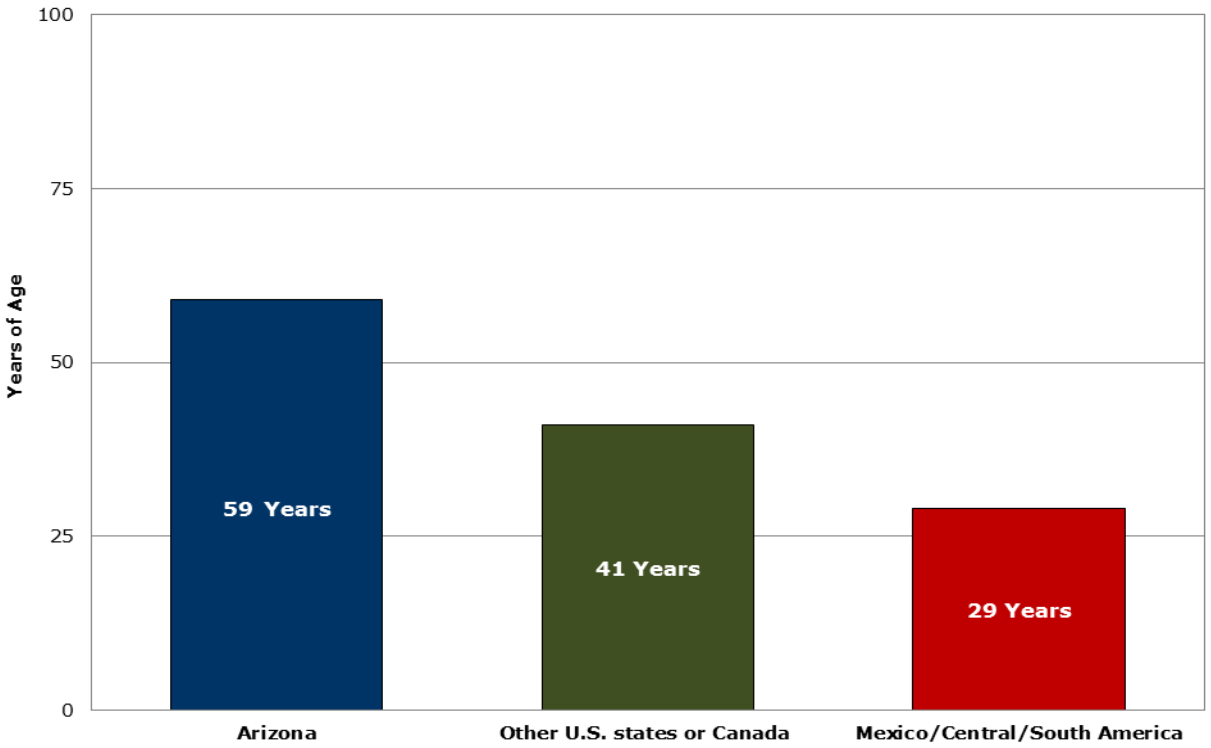
Figure 5A
Percent Distribution of Deaths from Exposure to Excessive Natural Heat* occurring in Arizona by Age Group and Residence Status, 2005-2015



	Infants <1	Children 1 - 14	Adoles-cents 15 - 19	Young Adults 20 - 44	Middle-Aged Adults 45 - 64	Elderly 65+
Arizona	1.31	2.05	0.37	16.79	38.43	38.43
Other U.S. states or Canada	0.00	1.23	2.47	54.32	29.63	12.35
Mexico/Central/South America	0.00	1.57	13.16	73.87	11.00	0.00

* The underlying cause of death was classified as X30 by ICD-10.
Deaths from other or unknown county of residents are not represented in the graph.

Figure 6A
**Median Age at Death from Exposure to Excessive Natural Heat*
by Residence Status, 2005-2015**

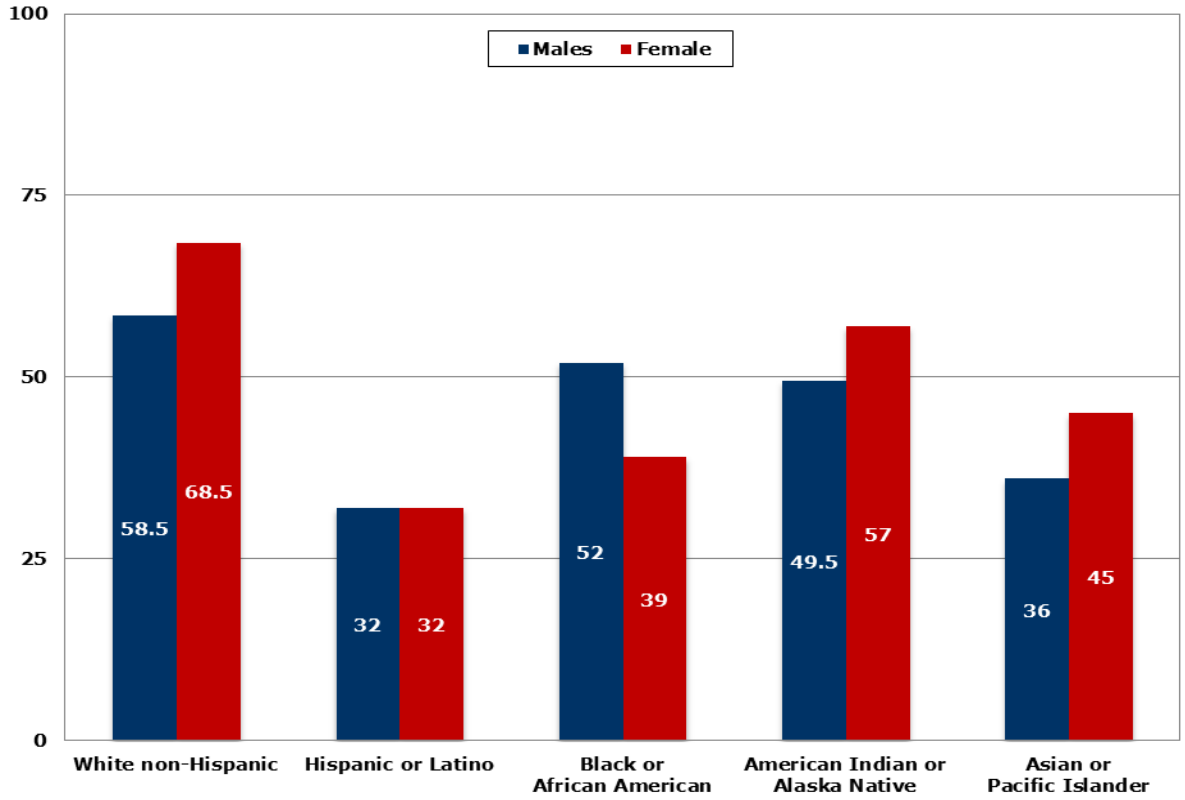


One out of two Arizonans who died from exposure to excessive natural heat in 2005-2015 was older than 59 years of age (**Figure 6A**, **Table 5A**).

In 2005-2015, compared to the residents of Arizona, on average visitors from other states were 18 years younger at the time of death. The median age of residents from Mexico, Central American or South American countries that died from exposure to excessive natural heat was 29 years of age, which was 30 years younger than the median age of deaths from residents of Arizona.

* The underlying cause of death was classified as X30 by ICD-10.
Deaths from other or unknown county of residents are not represented in the graph.

Figure 7A
**Median Age at Death from Exposure to Excessive Natural Heat*
by Gender and Race/Ethnic Group, 2005-2015**



In 2005-2015, White non-Hispanic females ranked highest with median age at death from exposure to excessive natural heat at 68.5 years, exceeding by 36.5 years the median age at death for Hispanic or Latino females (**Figure 7A, Table 6A**). White non-Hispanic males had the highest (58.5 years), and Hispanic males had the lowest (32 years), median age at death from exposure to excessive natural heat, respectively.

* The underlying cause of death was classified as X30 by ICD-10.

Table 1A
Characteristics of Deaths from Exposure to Excessive Natural Heat Occurring in Arizona by Year, 2005-2015

		Total	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total		1,272	225	137	111	88	120	137	123	97	103	48	83
State or Country of Residence	Arizona	536	77	63	34	34	38	50	57	53	56	32	42
	Other U.S. states or Canada	80†	8	7	6	*	7	8	11	12	8	*	6
	Mexico, Central or South America	509	116	49	67	40	55	58	40	23	26	8	27
	Other	10†	0	0	*	*	0	*	*	*	*	0	*
	Unknown	130†	24	18	*	6	20	19	14	8	12	*	6
Geographic Region of Occurrence[a]	Central	521	65	58	39	33	51	48	61	55	45	27	39
	Eastern	0	0	0	0	0	0	0	0	0	0	0	0
	Northern	50†	6	*	*	*	*	6	7	0	13	*	*
	Southern	685	153	72	67	50	64	81	55	41	45	18	39
	Western	10†	*	*	*	*	*	*	0	*	0	0	*
County of Occurrence	Apache	10†	0	*	0	*	0	0	*	0	*	0	0
	Cochise	10†	0	*	0	0	*	*	0	0	*	0	*
	Coconino	20†	*	0	*	0	*	*	*	0	*	*	*
	Gila	0†	0	0	0	0	0	0	*	0	*	0	0
	Graham	0†	*	0	*	0	0	0	0	*	0	0	0
	Greenlee	0	0	0	0	0	0	0	0	0	0	0	0
	La Paz	10†	*	*	*	*	*	*	0	*	0	0	*
	Maricopa	440	56	53	30	26	43	40	54	50	35	21	32
	Mohave	30†	*	*	*	*	0	*	*	0	7	*	*
	Navajo	0†	*	*	*	*	0	0	0	0	0	0	0
	Pima	548	116	50	54	41	50	74	49	35	38	13	28
	Pinal	60†	8	*	8	7	6	6	6	*	*	*	*
	Santa Cruz	50†	8	7	10	6	9	*	*	0	*	*	*
	Yavapai	20†	0	*	0	0	*	*	0	*	*	*	*
	Yuma	80†	29	14	*	*	*	*	*	6	*	*	7
Age Group	0 - 4	20†	*	*	*	*	0	*	0	*	*	*	*
	5 - 9	0	0	0	0	0	0	0	0	0	0	0	0
	10 - 14	10†	*	*	*	0	*	*	0	0	0	0	*
	15 - 19	70†	17	8	9	9	7	7	*	*	*	*	*
	20 - 24	100†	21	10	7	9	10	15	8	*	13	*	7
	25 - 29	120†	20	9	16	8	14	14	12	7	*	6	8
	30 - 34	100†	22	12	15	9	11	8	14	7	*	0	*
	35 - 39	120†	21	12	9	*	13	13	12	10	7	*	10
	40 - 44	90†	13	11	14	8	8	10	10	8	*	*	*
	45 - 49	90†	16	13	*	7	8	10	9	12	11	0	6

Table 1A (continued)
Characteristics of Deaths from Exposure to Excessive Natural Heat Occurring in Arizona by Year, 2005-2015

		Total	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Age Group (continued)	50 - 54	100†	17	12	10	9	10	11	8	*	8	*	*
	55 - 59	70†	7	10	*	*	*	*	6	7	6	*	9
	60 - 64	60†	6	10	*	*	*	*	10	7	*	*	*
	65 - 69	50†	*	*	*	*	6	*	*	*	*	*	7
	70 - 74	40†	8	*	0	*	0	*	*	7	*	*	7
	75 - 79	50†	*	*	*	*	6	6	6	7	*	*	*
	80 - 84	40†	8	*	*	*	*	*	*	*	6	*	*
	85+	50†	7	*	*	*	*	*	10	*	6	*	*
	Unknown	110†	27	7	*	*	14	19	7	*	12	*	*
Gender	Male	977	170	104	76	68	97	111	97	74	83	32	65
	Female	294	55	33	35	20	22	26	26	23	20	16	18
	Unknown	0†	0	0	0	0	*	0	0	0	0	0	0
Race/Ethnicity	White non-Hispanic	522	75	58	36	32	43	59	53	46	48	28	44
	Hispanic or Latino	660	136	70	72	50	69	70	59	43	43	16	32
	Black or African American	0†	0	0	0	0	0	0	0	0	0	*	*
	American Indian or Alaska Native	10†	0	0	0	0	0	0	0	0	0	*	*
	Asian or Pacific Islander	0†	0	0	0	0	0	0	0	0	0	0	*
	Unknown	80†	14	9	*	6	8	8	11	8	12	0	0
Month of Death	January	0†	0	0	0	0	0	0	*	0	0	0	0
	February	0†	*	0	0	*	0	0	0	0	0	0	0
	March	10†	*	*	0	*	*	0	*	0	*	0	0
	April	30†	7	*	*	*	*	*	*	*	*	*	*
	May	90†	23	10	9	*	12	8	*	9	9	*	*
	June	282	20	35	31	38	10	23	27	24	30	12	32
	July	503	120	77	35	24	53	71	30	28	39	17	9
	August	241	30	11	23	10	29	18	39	26	14	7	34
	September	80†	16	*	7	*	9	12	15	6	6	*	*
	October	20†	*	0	*	*	*	*	*	*	*	*	*
	November	10†	*	0	0	0	0	*	*	*	*	*	*
	December	0†	*	0	0	0	*	0	0	0	0	0	0
Autopsy Performed	No	388	131	51	20	16	24	19	36	34	27	12	18
	Yes	883	94	86	90	72	96	118	87	63	76	36	65
	Unknown	0†	0	0	*	0	0	0	0	0	0	0	0

Notes: * Cell suppressed due to non-zero count less than 6; † Sum rounded to nearest tens unit due to non-zero addend less than 6; a Classification of geographic regions: Central = Gila, Graham, Maricopa, Pinal, and Yavapai; Eastern = Greenlee; Northern = Apache, Coconino, Mohave, and Navajo; Southern = Cochise, Pima, Santa Cruz, and Yuma; Western = La Paz.

Table 2A

Characteristics of Arizona Deaths from Exposure to Excessive Natural Heat by Residence Status, 2005-2015

		Total	State or Country of Residence				
			Arizona	Other U.S. states or Canada	Mexico, Central or South America	Other	Unknown
Total		1,272	536	80†	509	10†	130†
Year of Death	2005	225	77	8	116	0	24
	2006	137	63	7	49	0	18
	2007	110†	34	6	67	*	*
	2008	90†	34	*	40	*	6
	2009	120	38	7	55	0	20
	2010	140†	50	8	58	*	19
	2011	120†	57	11	40	*	14
	2012	100†	53	12	23	*	8
	2013	100†	56	8	26	*	12
	2014	50†	32	*	8	0	*
	2015	80†	42	6	27	*	6
Geographic Region of Occurrence[a]	Central	520†	394	29	59	*	35
	Eastern	0	0	0	0	0	0
	Northern	50†	35	14	*	*	*
	Southern	690†	98	35	449	*	98
	Western	10†	9	*	0	0	0
Age Group	0 - 4	20†	15	0	*	0	0
	5 - 9	0	0	0	0	0	0
	10 - 14	10†	*	*	7	0	0
	15 - 19	70†	*	*	67	0	*
	20 - 24	100†	8	*	90	*	*
	25 - 29	120†	15	*	90	*	8
	30 - 34	100†	11	14	76	0	*
	35 - 39	120†	26	12	70	*	*
	40 - 44	90†	30	11	50	0	*
	45 - 49	90†	53	7	24	*	9
	50 - 54	100†	65	*	20	*	7
	55 - 59	70†	45	10	7	0	*
	60 - 64	60†	43	*	*	0	*

Table 2A (continued)

Characteristics of Arizona Deaths from Exposure to Excessive Natural Heat by Residence Status, 2005-2015

		Total	State or Country of Residence				
			Arizona	Other U.S. states or Canada	Mexico, Central or South America	Other	Unknown
Age Group (continued)	65 - 69	50†	40	*	0	0	*
	70 - 74	40†	35	*	0	*	*
	75 - 79	50†	46	*	0	0	0
	80 - 84	40†	36	*	0	*	0
	85+	49	49	0	0	0	0
	Unknown	110†	14	0	*	0	91
Gender	Male	977	386	63	405	9	114
	Female	290†	150	18	104	*	19
	Unknown	0†	0	0	0	0	*
Race/Ethnicity	White non-Hispanic	520†	350	49	8	*	110
	Hispanic or Latino	660†	109	27	500	*	19
	Black or African American	0†	*	0	0	0	*
	American Indian or Alaska Native	6	6	0	0	0	0
	Asian or Pacific Islander	0†	0	0	0	*	0
	Unknown	80†	69	*	*	0	*
Month of Death	January	0†	0	*	*	0	0
	February	0†	*	0	*	0	0
	March	10†	*	*	*	0	0
	April	30†	*	*	19	0	*
	May	90†	13	9	61	*	6
	June	280†	98	15	132	*	33
	July	500†	242	25	173	*	60
	August	241	126	13	80	0	22
	September	80†	36	11	25	*	10
	October	20†	*	*	10	0	*
	November	10†	6	0	*	0	*
	December	0†	*	0	*	0	0
Autopsy Performed	No	390†	255	22	84	*	24
	Yes	883	281	59	424	9	110
	Unknown	0†	0	0	*	0	0

Notes: * Cell suppressed due to non-zero count less than 6; † Sum rounded to nearest tens unit due to non-zero addend less than 6; [a] Classification of geographic regions: Central = Gila, Graham, Maricopa, Pinal, and Yavapai; Eastern = Greenlee; Northern = Apache, Coconino, Mohave, and Navajo; Southern = Cochise, Pima, Santa Cruz, and Yuma; Western = La Paz.

Table 3A

Characteristics of Arizona Deaths from Exposure to Excessive Natural Heat by Region, 2005-2015

		Total	Geographic Region of Occurrence[a]			
			Central	Northern	Southern	Western
Total		1,272	521	50†	685	10†
Year of Death	2005	230†	65	6	153	*
	2006	140†	58	*	72	*
	2007	110†	39	*	67	*
	2008	90†	33	*	50	*
	2009	120†	51	*	64	*
	2010	140†	48	6	81	*
	2011	123	61	7	55	0
	2012	100†	55	0	41	*
	2013	103	45	13	45	0
	2014	50†	27	*	18	0
	2015	80†	39	*	39	*
State or Country of Residence	Arizona	536	394	35	98	9
	Other U.S. states or Canada	80†	29	14	35	*
	Mexico, Central or South America	510†	59	*	449	0
	Other	10†	*	*	*	0
	Unknown	130†	35	*	98	0
County of Occurrence	Apache	10†	0	*	0	0
	Cochise	8	0	0	8	0
	Coconino	18	0	18	0	0
	Gila	0†	*	0	0	0
	Graham	0†	*	0	0	0
	Greenlee	0	0	0	0	0
	La Paz	12	0	0	0	12
	Maricopa	440	440	0	0	0
	Mohave	27	0	27	0	0
	Navajo	0†	0	*	0	0
	Pima	548	0	0	548	0
	Pinal	59	59	0	0	0
	Santa Cruz	52	0	0	52	0
	Yavapai	17	17	0	0	0
	Yuma	77	0	0	77	0
Age Group	0 - 4	20†	12	*	*	0
	5 - 9	0	0	0	0	0
	10 -14	10†	*	0	9	0
	15 - 19	70†	8	*	63	0
	20 - 24	100†	15	*	85	0
	25 - 29	120†	27	*	90	*
	30 - 34	100†	21	*	80	0
	35 - 39	115	24	7	84	0
	40 - 44	90†	41	*	48	0
	45 - 49	90†	58	*	33	0

Table 3A (continued)

Characteristics of Arizona Deaths from Exposure to Excessive Natural Heat by Region, 2005-2015

		Total	Geographic Region of Occurrence			
			Central	Northern	Southern	Western
Age Group (continued)	50 - 54	100†	68	*	25	*
	55 - 59	70†	38	7	20	*
	60 - 64	60†	35	*	17	*
	65 - 69	50†	32	*	9	*
	70 - 74	40†	31	*	6	*
	75 - 79	50†	34	*	8	*
	80 - 84	40†	24	6	7	*
	85+	50†	39	*	*	*
	Unknown	107	12	0	95	0
Gender	Female	977	390	34	543	10
	Male	290†	131	20	141	*
	Unknown	0†	0	0	*	0
Race/Ethnicity	White non-Hispanic	522	312	31	168	11
	Hispanic or Latino	660†	144	7	508	*
	Black or African American	0†	*	0	0	0
	American Indian or Alaska Native	10†	*	*	*	0
	Asian or Pacific Islander	0†	*	*	0	0
	Unknown	79	58	14	7	0
Month of Death	January	0†	*	0	*	0
	February	0†	0	*	*	0
	March	10†	*	*	*	0
	April	30†	*	*	20	0
	May	90†	15	*	74	*
	June	280†	100	7	172	*
	July	503	229	22	246	6
	August	240†	112	11	117	*
	September	80†	40	*	38	*
	October	20	12	0	8	0
	November	10†	*	*	*	0
	December	0†	0	0	*	0
Autopsy Performed	No	388	189	33	158	8
	Yes	880†	332	21	526	*
	Unknown	0†	0	0	*	0

Notes: * Cell suppressed due to non-zero count less than 6; † Sum rounded to nearest tens unit due to non-zero addend less than 6; [a] Classification of geographic regions: Central = Gila, Graham, Maricopa, Pinal, and Yavapai; Eastern = Greenlee; Northern = Apache, Coconino, Mohave, and Navajo; Southern = Cochise, Pima, Santa Cruz, and Yuma; Western = La Paz.

Table 4A
Deaths from Exposure to Excessive Natural Heat by Geographic Region of Occurrence in Arizona, and Residence Status, 2005-2015

		Total	Geographic Region of Occurrence[a]			
			Central	Northern	Southern	Western
State or Country of Residence	Arizona	536	394	35	98	9
	Other U.S. states or Canada	80†	29	14	35	*
	Mexico, Central or South America	510†	59	*	449	0
	Other	10†	*	*	*	0
	Unknown	130†	35	*	98	0
Total		1,272	520†	50†	690†	10†

Notes: * Cell suppressed due to non-zero count less than 6; † Sum rounded to nearest tens unit due to non-zero addend less than 6; [a] Classification of geographic regions: Central = Gila, Graham, Maricopa, Pinal, and Yavapai; Eastern = Greenlee; Northern = Apache, Coconino, Mohave, and Navajo; Southern = Cochise, Pima, Santa Cruz, and Yuma; Western = La Paz.

Table 5A
Median Age at Death from Exposure to Excessive Natural Heat by Geographic Region of Occurrence in Arizona, and Residence Status, 2005-2015

		Geographic Region of Occurrence[a]			
		Central	**Northern**	**Southern**	**Western**
State or Country of Residence	Arizona	58	68	59	65
	Other U.S. states or Canada	47	43	36	63
	Mexico, Central or South America	31.0	24	29	0
	Other	60.5	37	25	0

Note: [a] Classification of geographic regions: Central = Gila, Graham, Maricopa, Pinal, and Yavapai; Eastern = Greenlee; Northern = Apache, Coconino, Mohave, and Navajo; Southern = Cochise, Pima, Santa Cruz, and Yuma; Western = La Paz.

Table 6A

Median Age at Death from Exposure to Excessive Natural Heat by Race/Ethnicity and Gender, 2005-2015

Race/Ethnicity	Gender	Median Age at Death
White non-Hispanic	Male	59
	Female	69
	Total	63
Hispanic or Latino	Male	32
	Female	32
	Total	33
Black or African American	Male	52
	Female	39
	Total	52
American Indian or Alaska Native	Male	49.5
	Female	57
	Total	46
Asian or Pacific Islander	Male	36
	Female	45
	Total	40.5
Unknown	Male	55
	Female	56
	Total	57

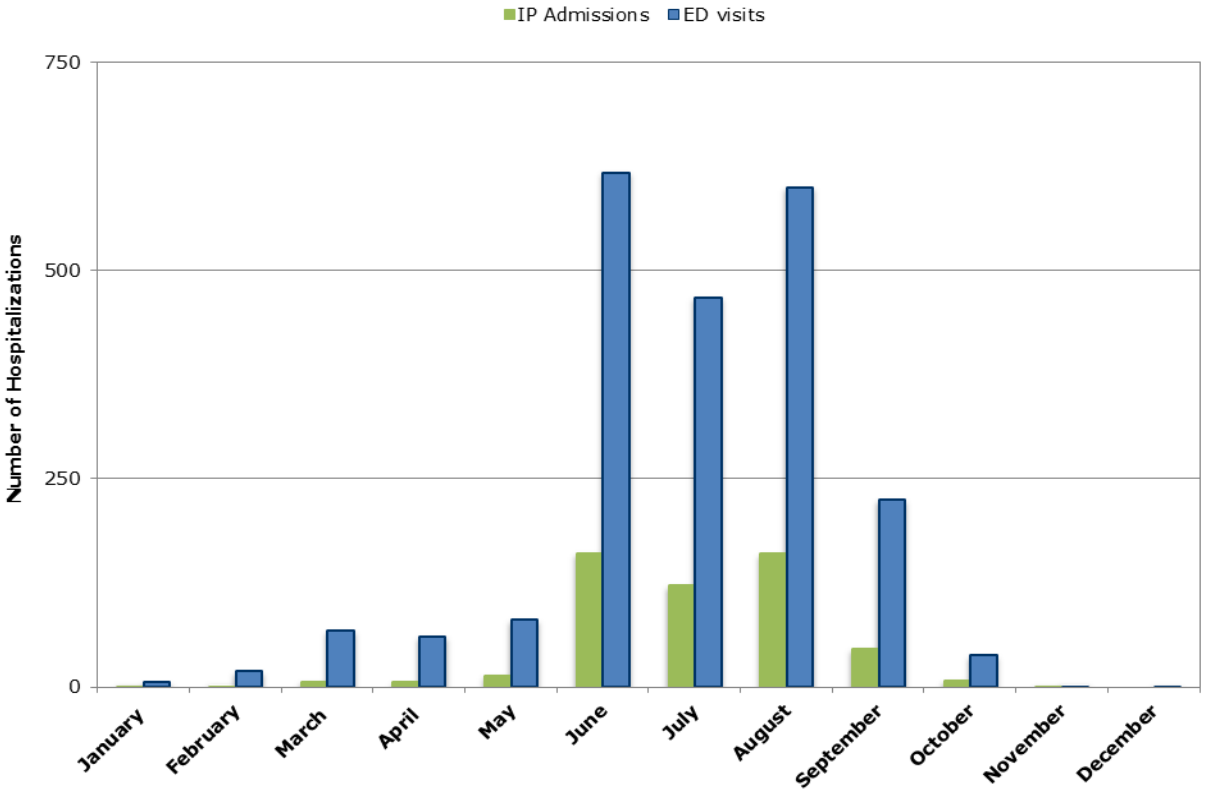
Section B: Heat-Related Morbidity, 2015

Arizona's Sonoran Desert covers a majority of the land in the southern half of Arizona. The Greater Phoenix metropolitan area is located in Central Arizona in the Sonoran Desert. Temperatures in Phoenix and elsewhere in the Sonoran Desert region oftentimes reach triple digits during the summer months (May-September). The mean high temperature in July is 107° F in the Central Arizona urbanized region.[5] The hot and arid climate during the summer months can increase the risk for getting a heat illness.

Not surprisingly, most illnesses from excessive natural heat occurred during late spring and summer (**Figure 1B**, **Table 1B**), with the highest number of heat illness emergency department (ED) visits and heat illness inpatient admissions occurring during the months of June, July, August, and September.

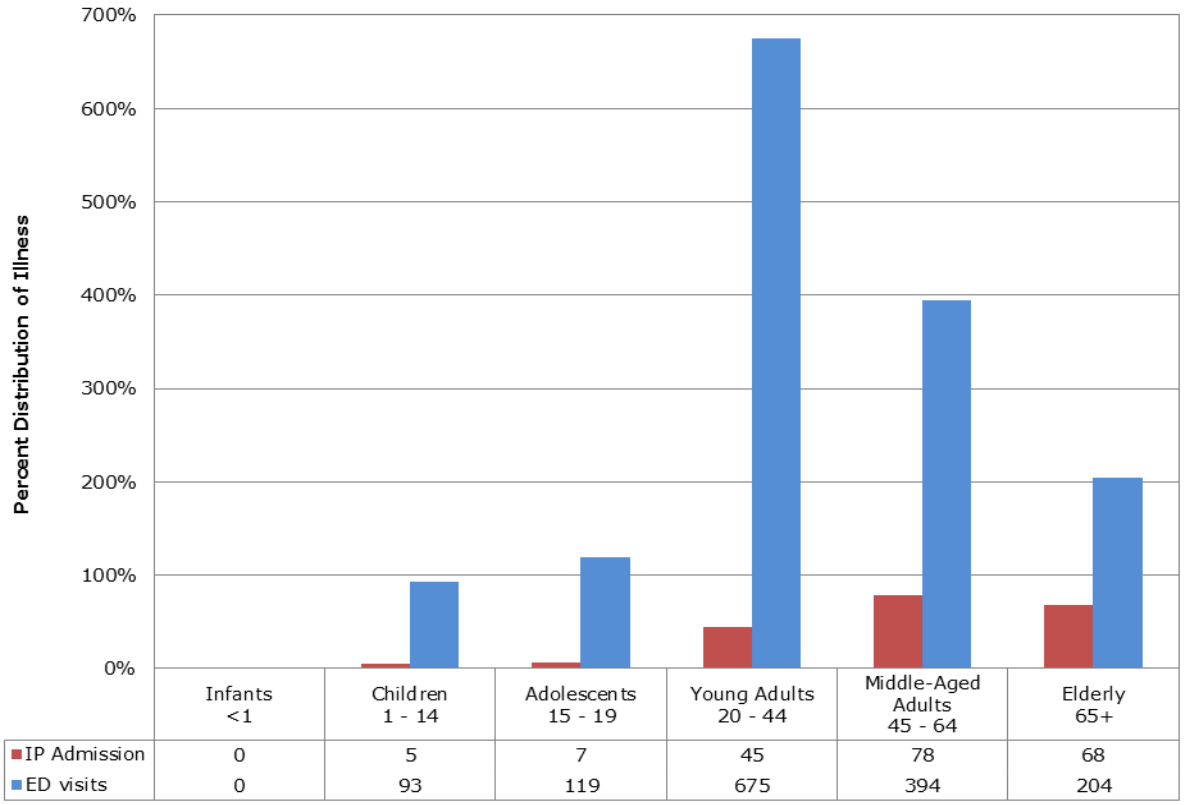
The warm season between June and September accounts for 93.14 percent of hospitalizations and 87.14 percent of the total ED visits from exposure to excessive natural heat.

Figure 1B
Hospitalizations from Exposure to Excessive Natural Heat occuring in Arizona by Month, 2015



5 See http://ral.ucar.edu/csap/events/climatehealth/2013/docs/s_harlan_heat_mortality.pdf

Figure 2B
Percent Distribution of Illness from Exposure to Excessive Natural Heat occuring in Arizona by Age Group, 2015



	Infants <1	Children 1 - 14	Adolescents 15 - 19	Young Adults 20 - 44	Middle-Aged Adults 45 - 64	Elderly 65+
IP Admission	0	5	7	45	78	68
ED visits	0	93	119	675	394	204

In 2015, illnesses (ED visits and IP admissions) from exposure to excessive natural heat occurred among all age groups except the infant group (<1 year old). Young adult residents of Arizona 20-44 years old accounted for 22.06 percent of IP admissions and 45.5 percent of heat illness ED visits. On the other hand, middle aged and elderly Arizona residents accounted for only 40.3 percent of heat illness ED visits for exposure to excessive natural heat, but represent 71.6 percent of IP admissions (**Figure 2B**).

Nearly 6.3 percent of heat illness emergency department visits were from Arizona resident children ages 1-14 years old, but Arizona resident adolescents 15-19 years old accounted for 8.0 percent of the total.

Figure 3B
Median Age at Illness From Exposure to Excessive Natural Heat by Gender, 2015

The median age at illness form exposure to excessive natural heat in 2015 was consistently higher among females for both IP admissions and ED visits. Gender differences with respect to age at illness tend to be larger for IP admissions compared to ED visits (**Figure 3B**). The median age of males visiting the emergency department for a heat illness was 5 years lower than the female median age at illness, but 8.5 years lower at time of admission for inpatient care. In 2015, the median age at admission to hospital due to exposure to excessive natural heat was generally higher compared to heat illness ED visits.

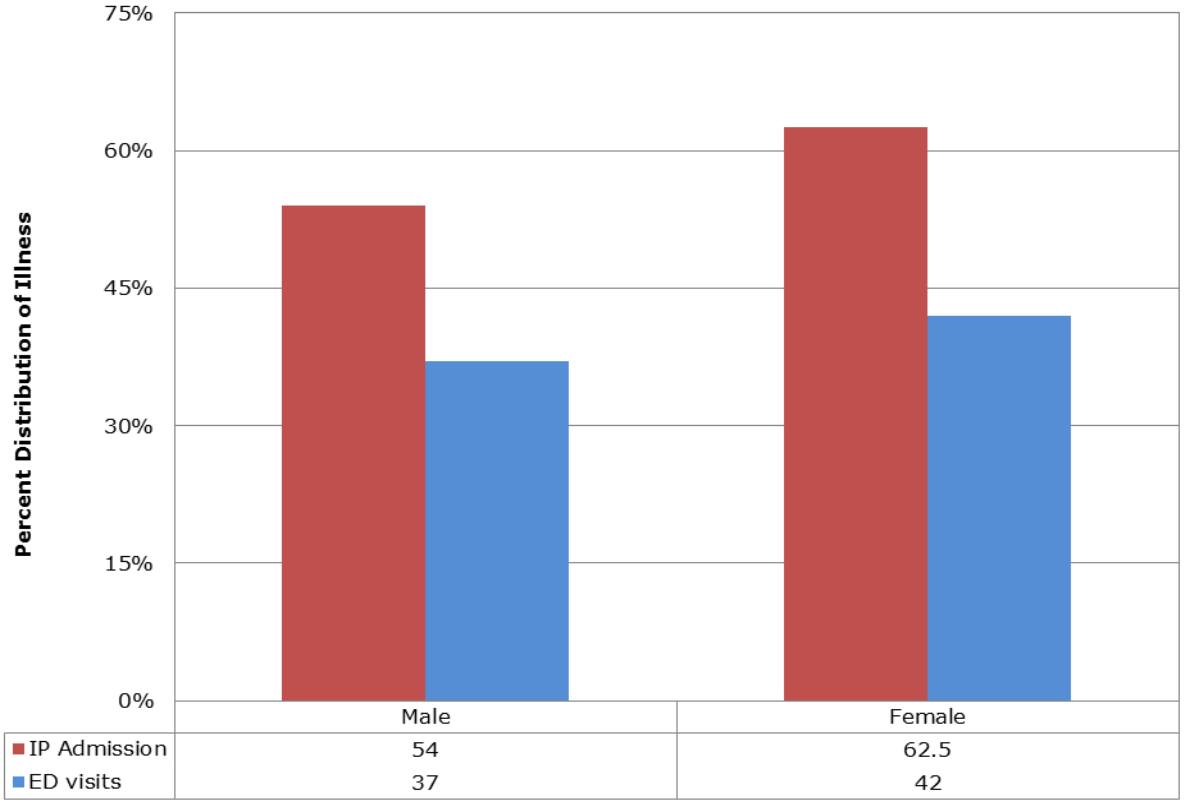
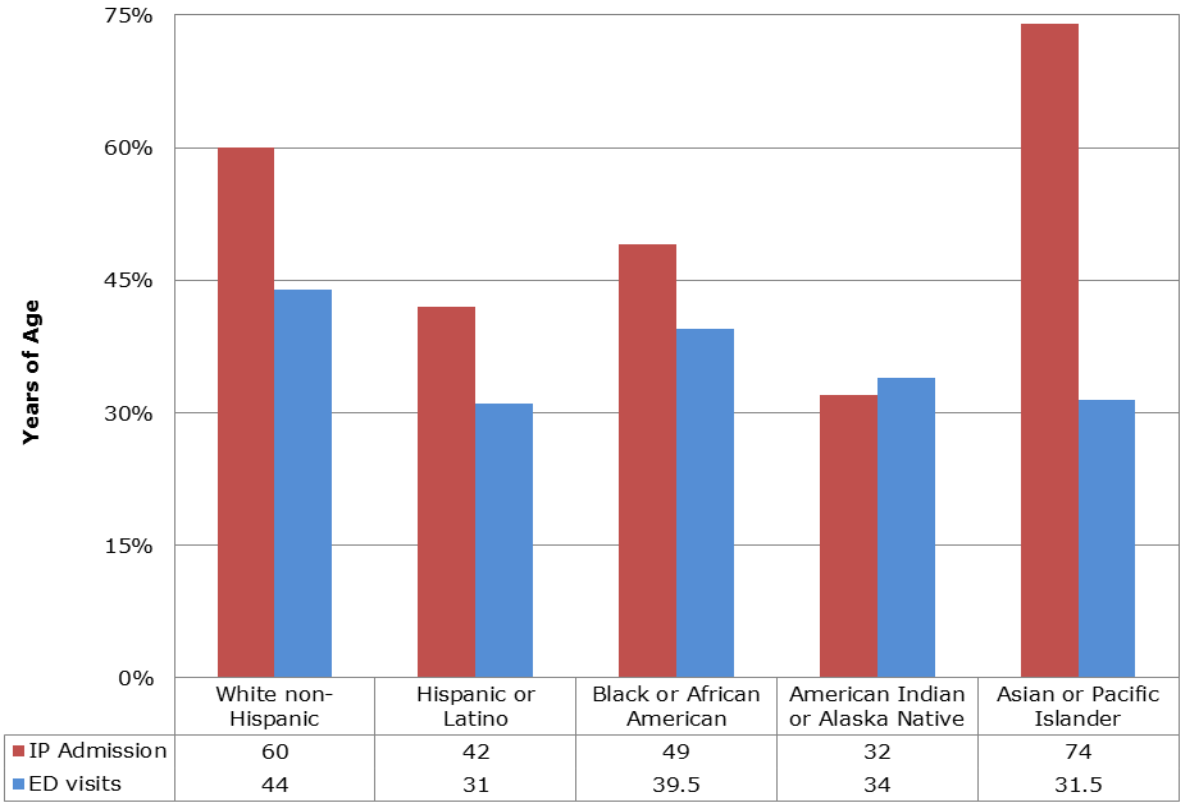


Figure 4B
Median Age at Illness from Exposure to Excessive Natural Heat by Race/Ethnic Group, 2015



	White non-Hispanic	Hispanic or Latino	Black or African American	American Indian or Alaska Native	Asian or Pacific Islander
IP Admission	60	42	49	32	74
ED visits	44	31	39.5	34	31.5

Median age at illness from exposure to excessive natural heat varies by race/ethnic groups. With respect to IP admissions, the median age at illness for Asians or Pacific were substantially the greatest while Hispanics or Latinos had the youngest age at illness. The median age of White non-Hispanics visiting the emergency department for a heat illness was 44 years of age, the highest among all race/ethnic groups, the lowest being recorded among Hispanic or Latinos (31 years) followed by American Indians (34) and Asians (31.5).

Table 1B

Inpatient stays and ED visits from Exposure to Excessive Natural Heat by Region and Demographic Characteristics, 2015

		Total	IP Admissions	ED Visits
Total		1,689	204	1,485
Geographic Region of Occurrence[a]	Central	1,088	137	951
	Eastern	27	0	27
	Northern	208	16	192
	Southern	366	51	315
	Western	0	0	27
County of Occurrence	Apache	0†	0	*
	Cochise	20†	*	14
	Coconino	20†	*	17
	Gila	15	0	15
	Graham	0†	0	*
	Greenlee	0	0	0
	La Paz	27	0	27
	Maricopa	957	131	826
	Mohave	177	13	164
	Navajo	10†	*	7
	Pima	160	25	135
	Pinal	80†	*	77
	Santa Cruz	10†	0	*
	Yavapai	30†	*	30
	Yuma	186	25	161
Age Group	0 - 4	20†	*	17
	5 - 9	24	0	24
	10 - 14	50†	*	44
	15 - 19	126	7	119
	20 - 24	147	7	140
	25 - 29	150†	*	143
	30 - 34	155	14	141
	35 - 39	149	11	138
	40 - 44	122	9	113
	45 - 49	116	18	98
	50 - 54	151	22	129
	55 - 59	122	19	103
	60 - 64	83	19	64

Table 1B (continued)
Inpatient stays and ED visits from Exposure to Excessive Natural Heat by Region and Demographic Characteristics, 2015

		Total	IP Admissions	ED Visits
Age Group (continued)	65 - 69	79	19	60
	70 - 74	69	19	50
	75 - 79	47	13	34
	80 - 84	30†	*	22
	85+	50	12	38
	Unknown	10†	*	8
Gender	Male	1,141	151	990
	Female	548	53	495
Race/Ethnicity	White non-Hispanic	1,061	133	928
	Hispanic or Latino	425	47	378
	Black or African American	97	13	84
	American Indian or Alaska Native	70†	*	69
	Asian or Pacific Islander	20†	*	18
	Unknown	10†	*	8
Month of Occurrence	January	10†	*	*
	February	10	0	10
	March	50†	*	50
	April	40†	*	40
	May	62	7	55
	June	486	68	418
	July	358	50	308
	August	469	55	414
	September	171	17	154
	October	30†	*	29
	November	0†	0	*
	December	0†	0	*

Notes: * Cell suppressed due to non-zero count less than 6; † Sum rounded to nearest tens unit due to non-zero addend less than 6; [a] Classification of geographic regions: Central = Gila, Graham, Maricopa, Pinal, and Yavapai; Eastern = Greenlee; Northern = Apache, Coconino, Mohave, and Navajo; Southern = Cochise, Pima, Santa Cruz, and Yuma; Western = La Paz.

Table 2B

Inpatient stays and ED visits from Exposure to Excessive Natural Heat by Region and Demographic Characteristics, 2015

		Total	Geographic Region of Occurrence[a]									
			IP Admissions					ED Visits				
			Central	Eastern	Northern	Southern	Western	Central	Eastern	Northern	Southern	Western
Total		1,689	140†	0	20†	50†	0	950†	27	190†	320†	0
County of Occurrence	Apache	4	0	0	0	0	0	0	0	*	0	0
	Cochise	20†	0	0	0	*	0	0	0	0	14	0
	Coconino	20†	0	0	*	0	0	0	0	17	0	0
	Gila	15	0	0	0	0	0	15	0	0	0	0
	Graham	3	0	0	0	0	0	*	0	0	0	0
	Greenlee	0	0	0	0	0	0	0	0	0	0	0
	La Paz	27	0	0	0	0	0	0	27	0	0	0
	Maricopa	957	131	0	0	0	0	826	0	0	0	0
	Mohave	177	0	0	13	0	0	0	0	164	0	0
	Navajo	10†	0	0	*	0	0	0	0	7	0	0
	Pima	160	0	0	0	25	0	0	0	0	135	0
	Pinal	80†	*	0	0	0	0	77	0	0	0	0
	Santa Cruz	5	0	0	0	0	0	0	0	0	*	0
	Yavapai	30†	*	0	0	0	0	30	0	0	0	0
	Yuma	186	0	0	0	25	0	0	0	0	161	0
Age Group	0 - 4	20†	*	0	0	0	0	11	0	*	*	0
	5 - 9	24	0	0	0	0	0	13	0	*	6	0
	10 - 14	50†	*	0	0	0	0	33	0	*	10	0
	15 - 19	130†	*	0	0	*	0	66	*	22	30	0
	20 - 24	150†	*	0	0	*	0	96	*	18	24	0
	25 - 29	150†	*	0	0	0	0	87	*	15	39	0
	30 - 34	160†	8	0	*	*	0	103	*	10	27	0
	35 - 39	150†	8	0	0	*	0	85	*	16	35	0
	40 - 44	120†	6	0	*	*	0	77	*	16	18	0
	45 - 49	120†	14	0	*	*	0	65	*	13	19	0
	50 - 54	151	15	0	0	7	0	90	*	17	18	0
	55 - 59	120†	11	0	*	6	0	64	*	19	19	0
	60 - 64	80†	14	0	*	*	0	40	*	7	14	0
	65 - 69	80†	11	0	*	6	0	37	*	9	12	0
	70 - 74	70†	15	0	*	*	0	31	*	9	8	0
	75 - 79	50†	8	0	*	*	0	20	*	*	8	0
	80 - 84	30†	*	0	*	*	0	11	*	*	6	0
	85+	50†	*	0	*	*	0	20	*	*	13	0
	Unknown	10†	*	0	0	0	0	*	0	*	*	0

Table 2B (continued)

Inpatient stays and ED visits from Exposure to Excessive Natural Heat by Region and Demographic Characteristics, 2015

		Total	Geographic Region of Occurrence[a]									
			IP Admissions					ED Visits				
			Central	Eastern	Northern	Southern	Western	Central	Eastern	Northern	Southern	Western
Gender	Male	1,141	99	0	10	42	0	643	17	121	209	0
	Female	548	38	0	6	9	0	308	10	71	106	0
Race/ Ethnicity	White non-Hispanic	1,061	93	0	12	28	0	587	21	161	159	0
	Hispanic or Latino	430†	27	0	*	16	0	230	*	15	129	0
	Black or African American	100†	11	0	0	*	0	65	*	0	18	0
	American Indian or Alaska Native	70†	*	0	0	*	0	49	*	13	6	0
	Asian or Pacific Islander	20†	*	0	0	*	0	15	0	*	*	0
	Unknown	10†	*	0	0	*	0	*	0	*	*	0
Month of Illness	January	10†	*	0	0	0	0	*	0	*	*	0
	February	10	0	0	0	0	0	7	0	0	*	0
	March	50†	0	0	0	*	0	33	0	6	11	0
	April	40†	*	0	0	0	0	27	*	*	8	0
	May	60†	6	0	0	*	0	35	*	8	10	0
	June	490†	41	0	*	24	0	266	10	53	89	0
	July	358	35	0	7	8	0	200	6	56	46	0
	August	470†	40	0	*	13	0	269	*	46	95	0
	September	170†	11	0	*	*	0	90	*	18	43	0
	October	30†	*	0	0	*	0	19	0	*	9	0
	November	3	0	0	0	0	0	*	0	0	0	0
	December	1	0	0	0	0	0	*	0	0	0	0

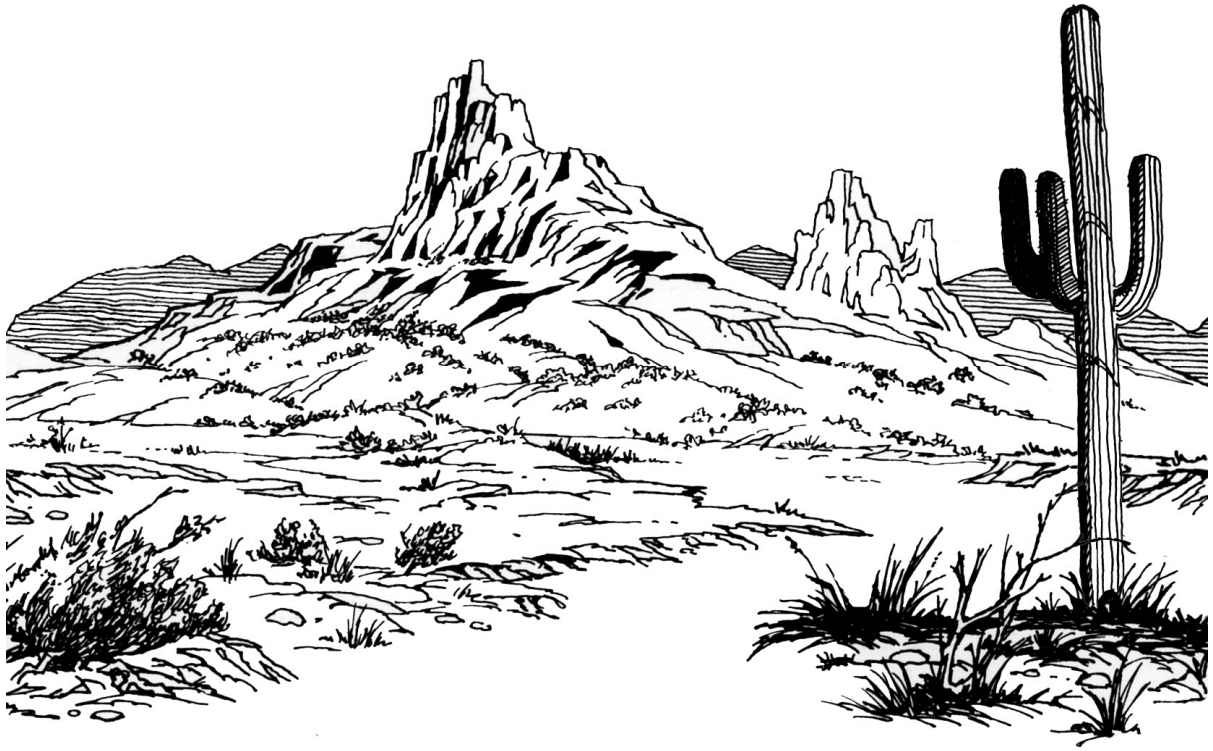
Notes: * Cell suppressed due to non-zero count less than 6; † Sum rounded to nearest tens unit due to non-zero addend less than 6; [a] Classification of geographic regions: Central = Gila, Graham, Maricopa, Pinal, and Yavapai; Eastern = Greenlee; Northern = Apache, Coconino, Mohave, and Navajo; Southern = Cochise, Pima, Santa Cruz, and Yuma; Western = La Paz.

Table 3B

Median Age at Illness from Exposure to Excessive Natural Heat by Race/Ethnicity and Gender, 2015

Race/Ethnicity	Gender	Median Age at Death	
		IP Admissions	ED Visits
White non-Hispanic	Male	57.5	43
	Female	65	44
	Total	60	44
Hispanic or Latino	Male	42	30
	Female	57.5	33
	Total	42	31
Black or African American	Male	47	36
	Female	60.5	52
	Total	49	39.5
American Indian or Alaska Native	Male	30.5	34
	Female	32	35
	Total	32	34
Asian or Pacific Islander	Male	90	24
	Female	74	54
	Total	74	31.5
Unknown	Male	0	58
	Female	46	43
	Total	46	43.5

Our Web site at http://www.azdhs.gov/plan provides access to a wide range of statistical information about the health status of Arizonans. The Arizona Health Status and Vital Statistics annual report examines trends in natality, mortality, and morbidity towards established health objectives. In addition to the print and original online versions, the 2015 report is made available as a mobile-friendly e-book (http://azdhs.gov/plan/epub/rotated-document-layout/). Additional reports and studies include Advance Vital Statistics by County of Residence, Injury Mortality among Arizona Residents (accidents, suicides, homicides, legal intervention, firearm-related fatalities, drug-related deaths, drowning deaths, falls among Arizonans 65 years or older), Hospital Inpatient and Emergency Room Statistics (first-listed diagnosis, procedures, mental disorders, asthma, diabetes, influenza and pneumonia, and substance abuse), Community Vital Statistics, Teenage Pregnancy, Differences in Health Status Among Racial/Ethnic Groups, and Health Status Profile of American Indians in Arizona.



ARIZONA DEPARTMENT OF HEALTH SERVICES
Bureau of Public Health Statistics
Population Health and Vital Statistics Section